Hind wing with terminal dots rather large and sharp.

Underside similar to that of *napariata*, fore wing rather more suffused.

Sierra del Libano, Dept. Magdalena, Colombia, 6000 feet (*H. H. Smith*); type ♂ and three ♀ ♀ in coll. Joicey.

7. *Scopula toxophora*, sp. n.

♀.—25 mm.

Nearest to *habilis*, Warr. (Nov. Zool. vi. p. 31). Body and wings above and beneath much more ochreous.

Fore wing with antemedian line curved in cell, not (as in *habilis*) angulated; postmedian slightly less oblique, anteriorly (about R^1) forming a much stronger outward curve than in *habilis*; cell-dot obsolete.

Hind wing with termen not appreciably elbowed; cell-dot obsolete.

Fore wing beneath rather glossy, proximally somewhat suffused with rosy grey; antemedian line and cell-dot obsolete, postmedian line feeble, obsolete anteriorly; hind wing unmarked; both wings with terminal line rather weaker than above.

Bitje, Ja River, Cameroons, 2000 feet, Oct.–Nov. 1912 (*G. L. Bates*); type in coll. Joicey.

XXVII.—*Notes on the Genus* Cricetomys, *with Descriptions of Four new Forms.* By Martin A. C. Hinton.

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In determining some specimens of *Cricetomys* from Zanzibar and the southern part of the Congo Basin, I have had occasion to work through all the material in the British Museum. This material, although extensive, is scarcely sufficient for an attempt to revise the whole genus. Many forms have been described, but with one exception all have been treated as mere subspecies of *C. gambianus* by modern workers—in my opinion, four species at least are at present included under the name.

1. *Cricetomys gambianus*, Waterhouse.

An examination of Waterhouse's type shows that the name *gambianus* is applicable only to the harsh-furred white-bellied forms ranging eastwards from the Gambia and

Senegal to the S.E. Soudan and the country between the Nile and the Congo. Southwards this species extends into Southern Nigeria and the Welle Basin, its range partly overlapping that of the sleek-furred species of Western and Central Africa.

C. gambianus, as I understand it, is a comparatively small species, in which the hind foot rarely measures more than 65 mm., while the condylo-basal length of the adult skull rarely exceeds 67 mm. It has loose harsh fur, which varies in density according to the subspecies. The general dorsal colour is a rather cold grey, which may or may not be more or less darkened along the spine and over the rump by long black hairs. The ears are dusky and in conspicuous contrast with the rest of the dorsal surface. The underparts are white separated from the flanks by regular, though often not very sharp, lateral lines of demarcation. The feet are whitish above, with more or less extensive dusky markings, the proximal half or third of the tail is dusky, the remainder being white.

The skull and teeth are normal; the palate without a posterior median spine, but often with a minute median notch. The bullæ show a certain amount of subspecific variation in size; and more important variations, dependent upon the development of the jaw-muscles, are discoverable between the subspecies in the region of the infraorbital canal when the skulls are studied with sufficient care.

Four subspecies, inclusive of a new one described below, are now known; but others will probably deserve recognition when further material comes to hand. These subspecies are:—

1. *C. g. gambianus*, Waterhouse.
   Gambia and Senegal; type B.M. 55. 12. 24. 136 from the Gambia.
2. *C. g. dichrurus*, Osgood.
   Anambara River, S. Nigeria; type B.M. 5. 12. 1. 21, ♀ adolescent.
3. *C. g. oliviæ*, Dollman.
   Bornu, N. Nigeria; type B.M. 11. 5. 12. 9, male.
4. *C. g. grahami*, subsp. n.

C. gambianus grahami, subsp. n.

Type.—An adult male (B.M. 19. 3. 2. 1), collected on November 1, 1918, on the Nuba Mountains, S.E. Soudan (altitude 1500′), by Major C. Graham and presented by him to the National Collection. No other specimen known.

Description.—In dorsal colour this form makes a nearer approach to *dichrurus* than to other subspecies of *gambianus*; but the cranial characters are closely similar to those of *oliviæ*.

In its harsh loose fur, cold grey dorsal colour, and sharply contrasted dusky ears, *C. g. grahami* resembles the other races of *gambianus*. In general external appearance, length and quality of the fur, markings of the hands and feet, and in the relative proportions of the black and white of the tail it agrees best with *dichrurus*. In the latter the black hairs of the back are so abundantly developed that one could almost describe the rump as being "clouded" with black; in *grahami* this is not the case, although the black hairs are far more numerous and obvious than in true *gambianus* and *oliviæ*. The specimens obtained by Emin Pasha in Monbuttu are lighter-coloured and have thinner fur.

In the skull the nasals are a little shorter relatively than in *gambianus* and *dichrurus*, about as in *oliviæ*; nasal length equals 40·4 % of condylo-basal length in *grahami*, 39·5–40·1 % in *oliviæ*, and 41·5–42·4 % in *gambianus* and *dichrurus*. The anterior palatal foramina are also short relatively; their length equals 8·6 % of condylo-basal length in *grahami*, 8·9–11·6 % in *oliviæ*, and 11·7–13 % in *dichrurus* and *gambianus*.

As is well known, the cranial differences observable between closely allied species or subspecies of rodents chiefly involve characters which depend upon the greater or less development of one or other of the elements of the jaw-musculature. In order to appreciate such differences it seems better to compare the measurements relating to them with a standard representing the working surface of the jaws alone rather than with one which involves the brain-case as well; the length between the anterior face of the upper incisor and the posterior edge of $m.^3$ seems to be a good constant for such a purpose. In the subjoined table certain measurements relating to the masseter and temporal muscles are shown as percentages of this constant. With regard to the masseter system, the anterior part of the *masseter medialis*, passing through the infraorbital canal, would seem to be most strongly developed in *gambianus* and *dichrurus*, while its surface of origin is shortened and its bulk slightly reduced in *grahami*, the reduction in bulk being carried still further in *oliviæ*; the development of the *masseter lateralis* in so far as it is indicated by the diameter of the zygomatic plate seems to stand, generally speaking, in an inverse relation to the development of *masseter medialis*. Characters dependent upon the development of the temporal and pterygoid muscles

may be similarly investigated ; but in the case of the *temporalis*, far greater changes transpire with advancing age than is the case with the masseter system. The material before me in the present instance is not rich enough in old skulls to lead to any definite result beyond the fact that the posterior portion of the *temporalis* is stronger in those forms with a relatively weak *masseter medialis* than in those in which the latter muscle is more powerfully developed :—

Incisor to $m.^3 = 100$:—

Masseter medialis.	*grahami.*	*olivie.*	*gambianus.*	*dichrurus.*
Length of preorbital fossa for origin of *Masseter medialis*	31·2	31–34·5	36·8–37·7	37·3
Greatest transverse diameter of infraorbital canal.....	26·5	22·3–25·7	27·1–29·2	27
Masseter lateralis.				
Least antero-posterior diameter of outer wall of infraorbital canal	17·8	16·3–17·7	14·5–16·4	15·4
Temporalis.				
Mastoid breadth minus the least distance between temporal ridges behind.	32·7	31·2	29·1	28·8

Collector's measurements of type.—Head and body 300 mm. ; tail 357 ; hind foot 70 ; ear 35 (hind-foot measurement too large, 65 on skin).

Measurement of skull.—Condylo-basal length 62·4 ; zygomatic breadth 31·7 ; interorbital constriction 9·3 ; mastoid breadth 23·4 ; nasals 25·2 × 8·8 ; incisor to $m.^3$ 34·3 ; diastema 20 ; length of anterior palatal foramina 5·4 ; length of preorbital fossa for masseter medialis 10·7 ; least diameter of zygomatic plate 6·1 ; molar crowns 10·4.

2. *The* emini *or sleek-furred group.*

In the southern part of the tract occupied by *C. gambianus* and in the forested region to the south of it we meet with a number of forms which, if judged by external appearance alone, would all be referred to one single species. The forms in question range from the Gambia, Fernando Po, Gold Coast, and adjoining countries on the west, eastwards and southwards right through the Congo Basin ; they appear also to have an outlying representative in the island of Zanzibar. All are characterized by the possession of soft, sleek, and silky fur, which varies in length and density in different parts of the enormous range indicated. Beneath the uniform coats a great wealth of variation is displayed in the skulls ; and I

believe that these forms represent several perfectly distinct species. It is difficult to compare skulls of *poensis*, *dolichops*, and *emini* without coming to such a conclusion. Far more material is needed, however, before any attempt to work out the relationships can succeed. On the present occasion I have to describe two new forms: one from the southern part of the Belgian Congo, best treated as a subspecies of *C. emini*, Wroughton; the other from the island of Zanzibar, provisionally accorded full specific rank.

Cricetomys emini sanctus, subsp. n.

Type.—An adult male (teeth more than half-worn) collected at Inkongo, Sankuru, on August 27, 1912, by Mr. H. Wilson; B.M. 13. 4. 7. 5. No other specimen known.

Description.—Compared with typical *C. emini*, this form differs in having much shorter and thinner, though equally sleek fur, and more importantly in its much paler coloration and smaller size.

The back is a light brown approaching clay-colour, while the flanks are still lighter; underparts pure white. The ears and a stripe extending forwards between the eyes dusky; owing to the pallid dorsal coloration the ears are more strikingly contrasted with the pale cheeks and surrounding parts than in typical *emini*. The feet are brown, practically concolor with the back. The white of the tail occupies rather more than the terminal third.

Apart from its smaller size the skull differs from that of typical *emini* only in having relatively shorter palatal foramina; their length amounts to 9·8 % of the condylo-basal length instead of 11·7–13·4 % as in true *emini*.

Collector's measurements.—Head and body 297 mm.; tail 395; hind foot 69; ear 38.

Measurements of skull (with corresponding dimensions of the type of *emini* in brackets).—Condylo-basal length 65·1 (74·6); zygomatic breadth 30·8 (35·4); interorbital constriction 10·3 (11·4); mastoid breadth 23 (26·6); nasals 27·9 × 9·2 (32·7 × 11·1); incisor to $m.^3$ 35·7 (40·2); diastema 22·1 (24·1); length of anterior palatal foramina 6·4 (9·5); length of preorbital fossa for masseter medialis 11·8 (13·6); least diameter zygomatic plate 5·6 (7); molar crowns 10·1 (11·4).

Cricetomys cosensi, sp. n.

Type.—An adult female (B.M. 19. 6. 9. 20) collected by Mr. H. H. Swinny on the island of Zanzibar on April 29, 1919; presented to the National Collection by Colonel Cosens.

In addition to the type we have from Zanzibar three specimens collected by Mr. J. T. Last and an adult male collected and presented by Dr. Aders.

Description.—Apart from its larger size this species is very similar in outward appearance to *C. emini sanctus*, just described. The fur is short and thin, but quite soft and sleek. In four of the specimens, including the type, the general colour of the back ranges from russet or cinnamon to mummy-brown; but one sent by Dr. Aders is considerably darker. There is no distinct trace of mid-dorsal darkening in any. The underparts are thinly clothed with pure white or yellowish hairs. The ears are brown, nearly matching the dorsal colour. The hands are whitish in colour from the wrists. The feet are dark brown above, with the digits and inner margins whitish. The terminal half of the tail is white.

The skull is about as large as in *emini* (condylo-basal length 68–73·3 mm.), and considerably larger than in *gambianus*; it agrees with that of *emini* further in its relatively small zygomatic breadth; this dimension expressed as a percentage of the condylo-basal length ranges between 46·7 and 47·8 in *cosensi*, 45·4–47·8 in *emini*, and 49–52·5 in *gambianus*. The anterior palatal foramina are relatively larger than in *emini*, their lengths ranging between 12·5 and 14·2 % of the condylo-basal length instead of between 9·8 and 13·4 %, and the breadth 4·9–6·2 % instead of 4·3–4·8 %. In other respects the skull agrees with that of *emini*.

Collector's measurements of type (with dimensions of Dr. Aders's specimen in brackets).—Head and body 343 (369) mm.; tail 390 (381); hind foot 70 (72); ear 41.

Measurements of skull of type (with those of Dr. Aders's specimen in brackets).—Condylo-basal length 72 (73·3); zygomatic breadth 33·6 (34·7); interorbital constriction 11·3 (10·6); mastoid breadth 25·1 (25·4); nasals 31 × 10 (33·3 × 10); incisor to $m.^3$ 39·8 (40·7); diastema 24·2 (24·7); length of anterior palatal foramina 10·2 (9·7); length of preorbital fossa for masseter medialis 14·4 (14·5); least diameter of zygomatic plate 6·3 (5·3); molar crowns 10·7 (10·7).

Remarks.—The Zanzibar *Cricetomys* is of quite exceptional interest, and I have much pleasure in naming it after Colonel Cosens, who is most generously finding the funds for Mr. Swinny's collecting work. The nearest geographical allies of *C. cosensi* are the mainland forms named by Heller *C. g. enguvi* and *C. g. osgoodi*; but these in common with the numerous mountain races described from East Africa are animals of a wholly different type. They resemble *gambianus*, as well as the southern subspecies *viator*, *cunctator*,

and *adventor*, described from the region between Lake Nyassa and Zululand, in having long loose fur which imparts a characteristic shaggy appearance—and in their skulls, of course, they have their own peculiarities. On the other hand, *cosensi* is clearly very closely allied to the geographically remote *emini*, differing from the typical race of the latter species in little beyond its paler coloration and thinner fur.

3. *Other groups.*

The discussion of the relationships of the E. African members of the genus must be reserved for another occasion. Thomas has described a very distinct species, *C. ansorgei*, from Angola ; this animal is of large size and the characters of its coarse pelage, dark ventral coloration, large skull, and teeth have suggested a possible affinity with some of the E. African forms. The skull-characters, however, seem to show that there is no close affinity between *ansorgei* and the many mountain forms from E. Africa. I would take this opportunity to describe a *Cricetomys* from Lagos which, resembling *ansorgei* in external appearance, is of far smaller size. It may be known as

Cricetomys servorum, sp. n.

Type.—An adult female (B.M. 10. 10. 24. 2) from Lagos ; collected and presented by Captain Lawrence.

Description.—This species closely resembles *C. ansorgei* in general appearance ; it is distinguished by its much smaller size (hind foot about 60, instead of 72–79 mm.) and by various cranial peculiarities.

The fur is loose, thin, and of harsh quality. The general dorsal colour is near mummy-brown gradually lightening to grey on the flanks ; the flank-colour merges insensibly in the dark ashy grey of the underparts, the ventral hairs having slaty bases. Ears dull brown, sharply contrasted with the pale cheeks in front, but matching the dorsal colour behind. Hands and feet lighter dorsally, their colour being near Brussels brown ; the digits and lateral margins whitish. The tip of the tail is white, but much of the caudal epidermis has peeled off in the type and only known specimen, so that it is uncertain how far upwards the white extends.

The skull is distinguished from that of *ansorgei* by its much smaller size, small bullæ, relatively shorter nasals, longer diastema and anterior palatal foramina. It lacks the

rather prominent postorbital processes which are characteristic of the larger species.

Measurements.—Hind foot measured on the skin about 60 mm.

Measurements of skull (with corresponding dimensions of a skull of *ansorgei* in parentheses).—Condylo-basal length 68·7 (77) mm.; zygomatic breadth 33 ca. (38); interorbital constriction 10·2 (11·4); mastoid breadth 24·2 (27·1); nasal 28×10·1 (33×10·5); incisor to $m.^3$ 36·8 (42·3); diastema 22 (23·9); length of anterior palatal foramina 8·8 (8·2); length of preorbital fossa for masseter medialis 14 (14); least diameter of zygomatic plate 6·2 (8·1); molar crowns 10·5 (12·8).

XXVIII.—*The Method of taking the Incisive Index in Rodents.* By Oldfield Thomas.

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The angle at which rodent incisors protrude from the jaw has long been recognized as an important character of different groups, but it is only recently that an attempt has been made to define that angle more exactly, instead of merely speaking of "incisors thrown forward" and so on.

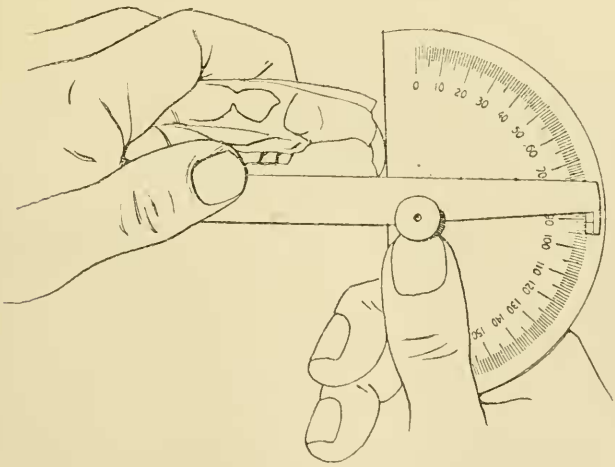

Diagram showing method of taking incisive index in rodents.

This angle, when exactly measured and defined, proves to be exceedingly useful as a systematic character, but it is essential that the way it is taken should be clearly understood.